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Botkin, Daniel B. The Moon in the Nautilus Shell: Discordant Harmonies Reconsidered Oxford: Oxford University Press, 2012.

Daniel Botkin's primary point in *The Moon in the Nautilus Shell* is that the environment should not be thought of as a steady-state system, a balanced perfection that humankind is throwing off balance. Rather, the environment is an ever-changing—and in the distant past as swiftly changing as it is now—dynamic system. We should not think that without our activities the environment would continue on, timeless and unchanging. That few believe this to be the case Botkin himself concedes in his opening pages, yet he returns to this point. This straw man, an environmental utopian not even Botkin believes in, is alluded to over and over again.

The subtitle of *The Moon in the Nautilus Shell: Discordant Harmonies Reconsidered* is a recognition of the fact that this volume is an expansion of Botkin's *Discordant Harmonies* (1990). Much if not all of the earlier volume has been folded into the new book's pages. At the time the first book was published, there was much more life in this straw man—there were then many more who honestly doubted global warming, for instance, and many who looked on environmental consciousness as a foolish fad. That Botkin chose to carry forward passages that suggest this is still the majority opinion is symptomatic of how *Moon in the Nautilus Shell* was assembled. There is a great deal of rearrangement of material from the earlier edition, and the main difference is the inclusion of digressions, anecdotes, and other argument-blurring elements in the newer version.

Botkin writes that he felt that his presentation of this material in the first version was too "subtle," and he wanted to make this rewrite more insistent. If it has such an effect on readers, it will be through sheer mass of detail. For readers who prefer taking in their information with a healthy (and at times obscuring) dose of anecdote, personal asides, and folksy tone, this may well be the preferred edition. In my reading, however, the argument, the thrust of Botkin's ideas, is here much more diffuse, even blunted, in comparison with the first book.

Botkin can, as can occasionally be seen here, write clearly and make his points with interesting, small twists, as when he reminds us that adaption and evolution are always one step behind: "Species do not come into instant equilibrium with a new climate; they are always in the process of responding to previous environmental change" (xiii). But such moments are subsumed in a text of shifting focuses. Passages of clarity give way to wandering arguments, then to tangential anecdotes on the order of how many books were in his father's library and how he is lucky to have such good friends as those who took him on a trip after his wife had died. Illustrative examples tend to go on well beyond making their point. At times the text stops to remind us where it has been and announce where it is going next, in the manner of a dissertation.

The discussion that gives the book its title initially comes across as fresh and intriguing. After reminding us that the nautilus shell grows according to "a simple but elegant mathematical formula," Botkin details how, as it grows,

> the chambered nautilus records two different rhythms of the solar system. . . . There are an average of 30 growth lines per chamber, one for each day of the lunar cycle, suggesting that a new chamber is put down each lunar month and a new growth line each day. This implies that the chambered nautilus contains in its shell two clocks: one timed to the sun, the other to the moon. These are relative clocks, marking the number of days within a lunar month. (323)

Botkin goes on to tell us that the most ancient fossils of these shells have only nine growth lines per chamber, suggesting that the moon used to orbit the earth much faster. The implications of this discovery also suggest a date for the emergence of the continents from the oceans. Fascinating stuff, but questions surround it. What in the description of the shell's growth suggests a connection to the sun? Why does this discussion arise after Botkin flies out of Venice? Because his mind "meandered from the thoughts of the shallow European sea to those of the far-off Pacific Ocean, and one of its humblest and most obscure creatures. . . ." (322)

And Botkin hereby accurately characterizes this book: it meanders.

Amidst the meandering, within the confusions and repetitions, there are many good points to be found, most of them by now familiar. (To give Botkin his due, they are now familiar is in part due to his earlier book.) Some examples: Botkin cautions us not to believe that scientific theories are unemotional, rational arguments, and reminds us that they arise from our value system, a subjective, morals-influenced construction specific to our time and culture. He points out some of the limitations of this construction, chiding the environmental protesters of the 1960s and 1970s for sharing with those they fought against an "industrial" view of how the world works. He also reminds us how events that may seem destructive from our human point of view can actually be healthy for the environment:

> In 1964 Richard Hartesveldt, a scientist studying the impact of tourists on the sequoia groves [in the Sierra Nevada], realized the giant fires might rely on fires to regenerate. Although fire had been believed to be important for some kinds of comparatively short-lived vegetation, Hartesveldt's was an extraordinary discovery: that even the largest and one of the longest-lived of all organisms requires disturbance to persist. (212-213)

These are all good points, and it never hurts to be reminded of them. But much of Botkin's book does only that, reminds us of ideas that have already been considered, often more clearly and in greater depth, elsewhere.

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